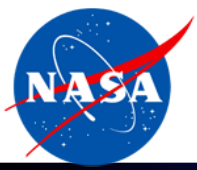




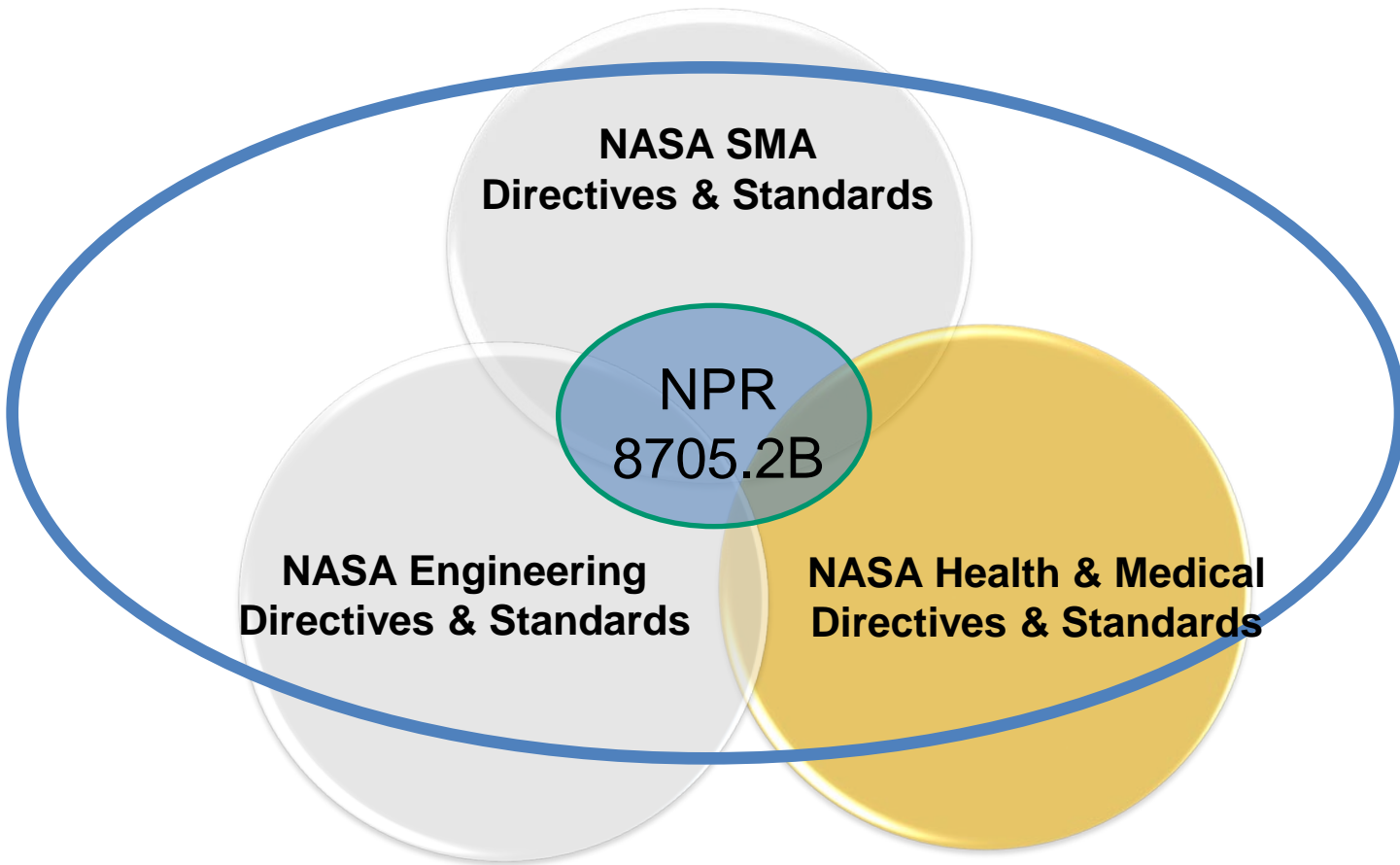
Human-Rating Implementation for Commercial Space

Department of Defense
Technical Advisory Group – Fall 2010

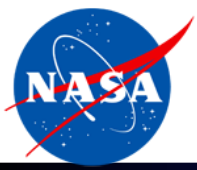


Big Picture of NASA Human-Rating

Vehicle/System design requirements fall within the blue circle.

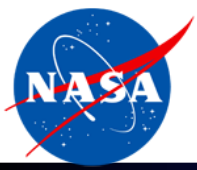


NPR 8705.2B Human-Rating Requirements for Space Systems includes requirements from each of NASA's three technical authorities.

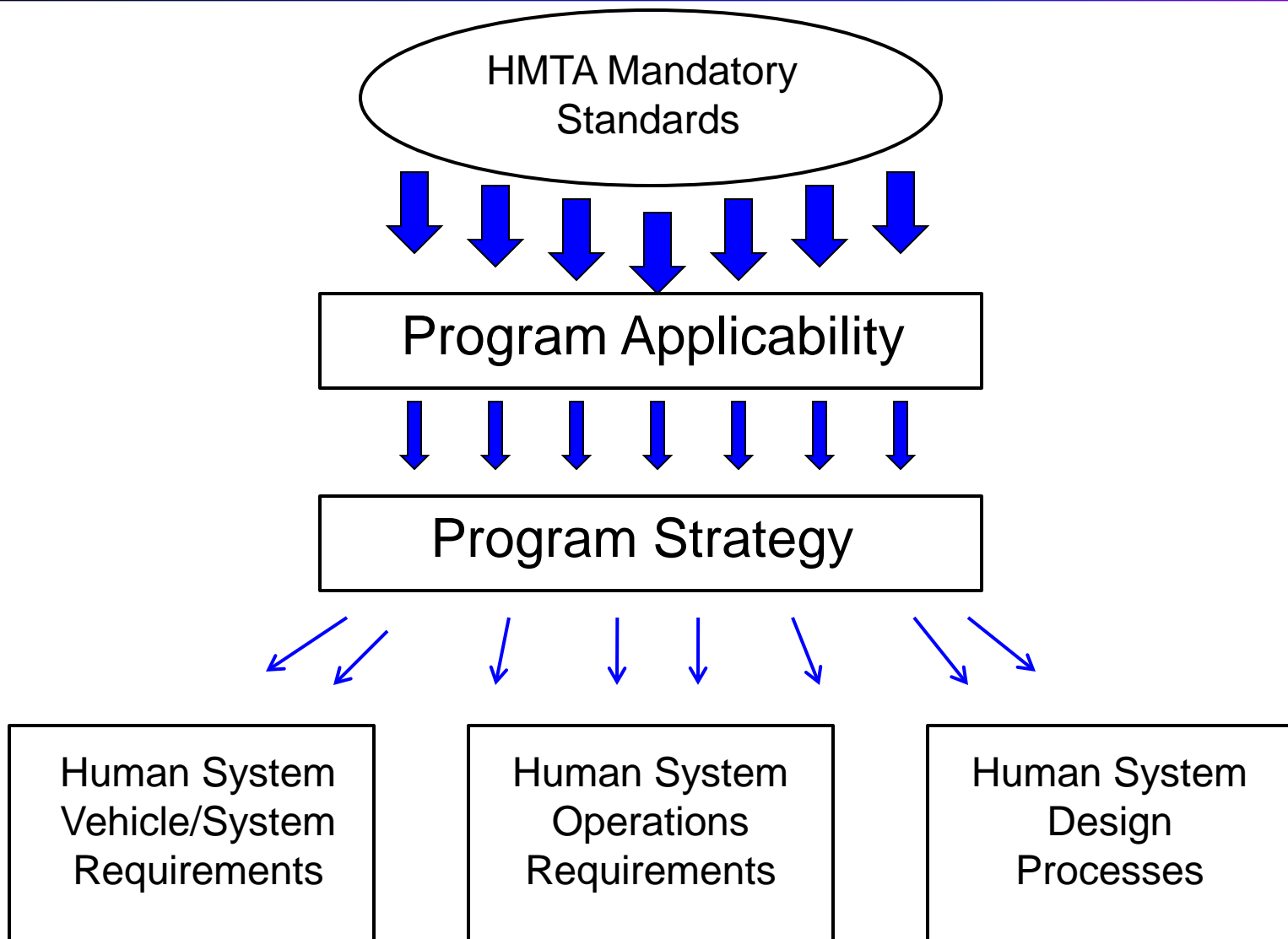


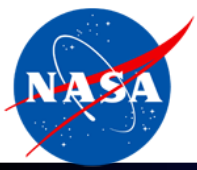
HMTA Mandatory Standards as per NPR 8705.2B

- ◆ **NASA-Standard-3001 Volume 1, Space Flight Human Systems: Crew Health**
 - Fully Applicable.
- ◆ **NASA-Standard-3000 Volume I - II, Man-Systems Integration Standards.**
 - This Standard is only invoked while NASA-STD 3001 Volume 2 is in the approval cycle. Once approved, NASA-STD 3000 will be superseded by NASA-STD 3001 Vol. 1 and 2.
- ◆ **FAA HFDS – Human Factors Design Standard.**
 - This Standard is applicable for ground processing and only Section 3, Automation, applies to flight systems.
- ◆ **MIL-STD-1472 Department of Defense Design Criteria Standard – Human Engineering.**
 - This Standard is applicable for ground processing only.



HMTA Approach for Human-Rating Application of Mandatory Standards

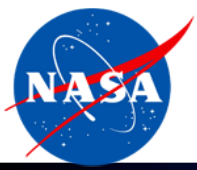




HMTA Requirements for Constellation Program

◆ Constellation Program (CxP) Human Rating Certification Package (HRCP)

- Summaries of the Program's approach to satisfying the requirements
- Linkage to the authoritative data within the Program that contains the detailed evidence
- Example Content:
 - SRR - Initial Release for a Program that includes the human rating approach and initial requirements compliance (including mandatory TA standards), and establishment of the ***Human Systems Integration Team (HSIT)***
 - SDR – Updates the SRR release and adds the ***safety analysis/crew workload & preliminary flight test plan***
 - PDR - Updates the SDR release and adds the ***human engineering testing/analysis*** and updated Flight test program with objectives linked to program needs
 - CDR - Updates the PDR release and adds the Programs Verification/Validation Plans for the ***Human Rating related requirements***
 - ORR - Updates the CDR release and adds the CM and Maintenance Plan for the system, Verification/Validation/Flight Test Results



HMTA Requirements for Constellation Program

◆ The CxP Human-Rating NPR Compliance Approach:

- Technical Requirements in NPR Chapter 3 Compliance Matrix - guidelines on how CxP complies with 8705 (interpretation based on CxP architecture)
- HRCP Appendix D Compliance Matrix (both procedural and technical requirements) - The table maps that NPR requirements to the CxP requirements as appropriate.
- Technical Requirements Trace
 - Used to support the demonstration of compliance by providing the evidence that the NPR requirements have been incorporated into the program's technical baseline

◆ CxP HMTA/HSI Role & Assessment Approach

- Primary HMTA/HSI Requirements → CxP Human Systems Integration Standards (HSIR)
- HMTA/HSI Led Teams: HSIT, Human Systems Integration Group (HSIG), Orion HSI Team
- Documenting the Program's compliance with the technical and process requirements in NPR 8705.2B (from HMTA/HSI perspective)
- Providing comments to HRCP at multiple reviews re the HRCP content
- At Orion Project level, assessment of design and analysis products from the **HSIR** compliance perspective; use of HSI tool (e.g., HSI scorecard, Human-in-the-Loop (HITL) evaluations)

◆ Current Status

- At CxP PDR, HRCP documentation met the requirements for the PDR milestone
- Work in progress to determine the **interim** human rating strategy for Human Flight Tests

JSC Center Director's Role in Human Rating per NPR 8705.2B

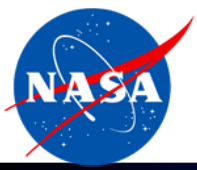
◆ NPR 8705.2B requires an endorsement at each major program review

1.5.2.1.1 The Technical Authorities and the Director, JSC endorse and approve the contents of the HRCP (Appendix D) as part of the review process using the endorsement form (Appendix E). Approval of the HRCP also constitutes approval of formal presentations to the Review Board that were made to satisfy certification requirements. The Director, JSC, evaluating risk to the crew, also endorses the HRCP at each milestone using the Appendix E form.

The JSC Center Director signs the endorsement as accepting the risk to the crew for the missions.

1.4.8 The Director, JSC is responsible for accepting the risk to the crew for missions conducted with the human-rated system. In this capacity, the Director, JSC shall:

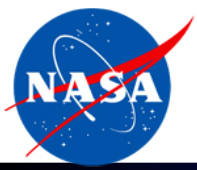
- a. From a crew risk perspective, determine the acceptability of the progress toward Human-Rating Certification (Requirement).
 - *Rationale: The determination of an acceptable level of risk to the crew at each of these milestones is accomplished by endorsing the HRCP at the program milestones.*
- b. From a crew risk perspective, determine the acceptability of the system for Human-Rating Certification (Requirement).
 - *Rationale: Designation of acceptability for Human-Rating Certification is accomplished by concurring on the Program Manager's Request for Human-Rating Certification.*
- c. Determine the acceptability of the risk to the crew for each mission (Requirement).
 - *Rationale: The determination of an acceptable level of risk to the crew is part of each mission or flight certification process, which includes a review of the Human-Rating Certification. Subject to the requirements of any international agreements, this determination also applies to international crew members.*
- d. Determine from a crew risk perspective the acceptability of residual safety risk associated with requests for exceptions and waivers to the requirements of this NPR (Requirement).



HMTA Requirements for Commercial Program

- ◆ Commercial Human Systems Integration Requirements (CHSIR)
 - Vehicle driving requirements
 - Tailored based on mission applicability and acquisition strategy
- ◆ Commercial Medical Operations Requirements Document (CMORD)
 - Service/operation driving requirements
 - Tailored based on mission applicability
- ◆ Commercial HSI Process document (CHSIP)
 - User guide for commercial spacecraft designers (tied to program requirements)
 - Deliverables mapped to systems engineering milestones
 - Key in development of NASA-defined milestones; [entrance/exit criteria](#)

Notionally, these requirements will not be levied in stand alone documents as in CxP, but will be incorporated directly into the Commercial Program documentation



Bottom Line: Human-Rating Objective

Following a Human-Centered Design process is essential to meeting NASA human-rating expectations.

